

PLAYING SURFACE SUBSTRATE, IN PARTICULAR TURF MATS

TECHNICAL FIELD

The present invention relates to a substrate material for use as a playing surface. In particular, the substrate material is for use as a playing surface substrate for practicing and/or playing golf.

BACKGROUND OF THE INVENTION

To facilitate learning or practicing the game of golf it is common to use the facilities provided at a golf driving range. Golf driving ranges generally provide practice areas provided with practice mats. Typically, the practice mats are rectangular in shape and are formed arranged to provide a player standing area and at least one or more pre-set location for placement of golf tees.

The practice mats are generally placed on the floor of the driving range, which is typically made from concrete or some other similar substance which is hard and non-resilient. In addition to the foregoing there are also commercially available relatively expensive practice mats. These mats are generally provided on raised support platforms which are formed from a rigid plastic material or wood.

It has been found that repeated playing off on practice areas of the above-mentioned types can lead to various repetitive stress injuries similar to tennis elbow. These injuries are generally caused by the inadvertent striking of the more or less hard non-resilient playing surface

of the practice mat/block with the golf club. The resulting jarring effect is transmitted to the joints (particularly the elbow and shoulder joints) of the player. Repeated jarring of the type has been found to result in injury to the connective tissue in and/or around the affected joints.

Practice mats/platforms of this type allow the player to practice and/or learn only a limited range of strokes. Only those strokes which require the golf ball to be resting on a tee or those strokes which do not require the club to strike the underside of the golf ball (for example, when putting back spin onto a golf ball) can be practiced. Playing strokes of the type which require the club to strike the underside of the golf ball greatly increases the possibility of the club striking the practice mat, and so increase the likelihood of injury to the player.

It is also a particular feature of these practice mats that there is only a limited number of pre-selected locations for placement of tees. This limitation of the restricted number and locations for placement of tees does not suit all of the many individual playing styles or the different statures of individuals wishing to use the practice mats/platforms.

SUMMARY OF THE INVENTION

It is an object of the present invention to avoid or minimize one or more of the foregoing disadvantages.

The present invention is directed towards the provision of a mat suitable for use as a playing surface which is flexible, resilient and can deform more or less like natural turf or grass

under the impact of a golf club. The mat is also robust enough to be walked upon without sustaining damage to the mat.

In a first aspect of the present invention, there is provided a mat suitable for use as a playing surface and comprises a honeycomb form support matrix packed with a filler material. The support matrix may be in the form of a more or less integrally-formed structures or conveniently is in the form of a close packed assembly of substantially upright tubes packed with filler material.

The tubes are generally formed from a reasonably flexible and deformable material to facilitate close packing thereof and enable the mat to yield under the impact of for example, a golf club. Suitable materials that may be mentioned include one or more of: plastics film or sheeting which is preferably biodegradable, paper, cardboard, and textile sheet materials of natural or synthetic fibers which may be woven or non-woven. Furthermore, the material used to fabricate the tubes may be porous or non-porous. It would be particularly desirable to choose a material which is porous to facilitate the movement of moisture (or excess water) into and out of the tubes thereby avoiding for example water-logging of the mat in wet conditions or in the case of over-watering.

The tubes are preferably generally cylindrical in shape, however they may be square, rectangle, elliptical or polygonal in section. Typically, the tubes are packed in a hexagonal close packed configuration. Alternatively, the tubes are arranged in a less closely packed arrangement such as a square close packed configurations. It will also be appreciated that with tubes of a

generally flexible material, the tubes may be deformed to a greater or lesser extent resulting in even closer packing together.

Typically, the tubes have a diameter of from 0.5 cm. (.197 inches) to 10 cm. (3.94 inches), preferably from 1 cm. (.394 inches) to 5 cm. (1.97 inches) and most preferably from 1 cm. (.394 inches) to 3 cm. (1.181 inches). The tubes typically have a height of from 3 cm. (1.181 inches) to 25 cm. (9.84252 inches), preferably from 5 cm. (1.97 inches) to 15 cm. (5.91 inches) and most preferably from 5 cm. (1.97 inches) to 10 cm. (3.94 inches). It will of course be realized that these dimensions can be altered and varied according to particular requirements.

Furthermore, it is also envisaged that tubes of different diameters may be present within the mat. In this case the arrangement of the tubes may be regular as above or it may be more random to accommodate the different sizes of tubes more efficiently. The tubes may also be closed at the bottom end portion to provide a tube which is open only at the top portion.

Adjacent tubes in the mat may be bonded or otherwise attached together at one or more shared edges or sides of said adjacent tubes. Preferably the tubes are glued together along the mutually co-operating edges or sides. The bonding of the tubes together has the beneficial effect of providing additional strength and robustness to the mat. Furthermore, bonding the tubes together allows easier handling and placement in use of the mat.

The filler material is generally packed into the tubes sufficiently tightly so that the filler material resists falling out of the tubes when the mat is being maneuvered or otherwise handled. On the other hand, it is normally desirable to avoid excessively tight packing that could result in

compaction of the filler and loss of resilience in the playing surface. Suitable packing conditions may be readily determined by simple trial and error.

Once packed with filler material, the tubes may optionally be sealed to provide a tube which is closed at the top and/or bottom portions. It is particularly desirable to seal the tubes where a material is used which is more prone to falling out of the tubes when the mat is being maneuvered or otherwise handled. Filler materials with little or no interlocking capacity such as sand, grit, polymer beads or chips and the like are examples of such filler materials.

The integrally-formed or close packed assembly structure of the mat allows easy handling by being in the form of a continuous layer of support matrix.

The mat of the present invention generally provides a playing surface more representative of natural turf and grass surfaces found on golf courses than the currently available golf practice mats/platforms. The mat has more naturally deformable properties due to the use of the filler material, in addition to reasonable structural stability, in use, (to lateral and vertically applied forces) when a golf club strikes the mat, when a player stands on the mat, and/or for the placement of golf tees. Furthermore, in use, when a player strikes the mat with a golf club, the mat deforms under the impact of the club in a manner very similar to natural turf or grass surfaces, with a reduced possibility of injury to the player over that of the prior art practice mats/platforms. The above-mentioned advantageous properties of the mat allow a player to play a wider range of strokes than is possible with currently available practice mats/platforms.

The filler material can be chosen to mimic the properties of a particular golf course or any other desired playing surface. To achieve this, the filler material conveniently comprises at least one of, the following materials: soil such as various types of loam, sphagnum moss, peat, wood chips/shavings, sawdust, clay, sand, polymer chips/beads/fragments and paper mache. Where a filler material is, for example, very fibrous, it will have a large number of interconnected and/or interwoven fibers which provide a stabilizing network within which it is possible to incorporate further non-fibrous or fibrous filler materials. The choice of filler material providing the stabilizing network of fibers, may be varied to adjust or modify the density of interconnected and/or interwoven fibers to provide a range of different stabilizing effects. For example, where a further filler material such as sand (which has little or no interlocking properties) is used, it may be necessary to use a filler material with a relatively high content and density of interconnected and/or interwoven fibers to prevent the sand from settling at the bottom of the support matrix, in order to maintain a uniform distribution of sand and fibrous filler material throughout the support matrix.

Where substantially non-absorbent and/or non-water swellable filler material is used e.g. sand, certain polymer chips/beads (it will be appreciated that some types of polymer chips/beads will be water absorbent and/or water swellable), it would generally be desirable also to include one or more other filler materials which are water absorbent and/or expandable (e.g. woodchips, sawdust, and sphagnum moss), depending upon the desired playing properties required of the mat.

It will be appreciated that materials such as loam are available with a wide variety of properties and textures and for example may be peaty, fibrous or non-fibrous or clay-like. The above-mentioned filler materials are not intended to be exhaustive, but merely illustrative of the types of filler material which may be used in accordance with the present invention.

The filler material (within the mat) may be used in either a wet or dry condition. It would generally be more convenient to have the filler material in the dry state for transportation of the mats in order to minimize carriage costs and facilitate handling of the mats. Once installed, the filler material can have water added thereto if so desired. Where it is desirable for the filler material in the mat to be in a wet/damp condition prior to installation it is desirable to use a support matrix which is resistant to the effects (such as rotting and tearing) of long term exposure to damp or humid conditions. The filler material and/or the material from which the material are fabricated, can also be admixed or treated with one or more additives to prevent mold or fungus (or other similar conditions) growing thereon through exposure to water or damp conditions.

It will be appreciated that the packing material will generally have a certain moisture content sufficient to prevent excessive or unwanted settlement thereof when in a non-use condition. This moisture content will of course vary from material to material and can readily be determined by simple experimentation.

The filler material within the tubes is preferably dry when the mat is being stored in a non-use condition. In this way the mat is relatively light and easy to maneuver. Before use, water can be added to the filler material. The water generally causes the material to swell and/or

become heavier and therefore becomes more tightly bound within the tubes and any supporting frame or container. The amount of water added to the mat in addition to the composition of the particular playing surface filler material can be varied to suit whichever playing surface condition(s) is desired to be mimicked, thereby increasing the variety and number of conditions available to play or practice on.

Preferably or alternatively, there may be used a binder material (in combination of the above-mentioned filler materials) which contains one or more additives which are capable of forming a semi-interpenetrating network (semi-IPN) or interpenetrating network (IPN) within the tube. The binder material can be used to bind together one or more filler materials that have little or no interlocking ability as described previously herein.

The use of a binder material allows the use of materials which would not normally be considered for use as such due to the lack of sufficient interlockability and/or being too dense and/or not being dense enough.

Binder materials are generally those which are not solvents for the filler material, and may be formed from one or a mixture of polymerisable monomers and/or polymers. Suitable monomers and/or polymers are preferably those capable of forming polyolefins and may be thermoplastic or thermosetting. When polyfunctional monomers and/or polymers are used, then a continuous cross-linked polymer system can be formed from the monomer and/or polymer. A semi-IPN is obtained when one of the co-continuous systems (i.e. the pre-existing polymer) is cross-linked. When both systems (i.e. the pre-existing polymer and the polymerised monomer)

are cross-linked, an IPN is formed. The formation of a semi-IPN/IPN within the tube also provides additional structural stability to the mat as a whole, in addition to helping to retain other filler materials in the tube.

The additive which forms the semi-IPN/IPN may be one, or a mixture or more than one, type of monomer which is polymerisable to form said semi-IPN/IPN. The polymerisation of the monomer(s) is preferably effected within the tubes prior to use of the mat. The polymerisation is preferably ionic, most preferably cationic.

Desirably urea and formaldehyde are co-monomers, which are polymerised to form a co-polymer. The urea and formaldehyde are co-polymerised by the addition of an acidic catalyst solution to the monomers.

Alternatively or desirably, paper maché may be mixed with binder or filler material and the paper maché, when set, provides further structural stability to the mat in addition to altering the mat playing characteristics.

The amount of paper maché and/or the amount of binder can be varied to achieve the desired balance of structural support and playing characteristics. This can be done as a matter off simple experimentation to achieve the desired results. For example, in packing material comprising paper maché and peaty loam, to increase the structural support provided by the packing material it is desirable to increase the proportion of paper maché relative to the peaty loam. To increase the resilience of the packing material it is desirable to increase the proportion of peaty loam relative to the paper maché.

Preferably, the filler material and the mat are derived from a material(s) which is (are) biodegradable or have previously been biodegraded and/or may be recycled for re-use as a filling material or other component of the present invention.

Conveniently, the mat is provided with an outer casing generally in the form of an open-top container with a base and sides inside which is more or less tightly packed said assembly of tubes packed with filler material. The container may be fabricated from plastic, metal, wood, cardboard or any combination of the foregoing. The base and/or sides may be provided with one or more holes to aid drainage therefrom.

The outer casing helps to maintain the structural integrity of the close packed tube assembly in use and during handling and facilitates transport and/or storage of the mats. Preferably, the sides of the container are no deeper than the height of the tubes of the surface playing material. Conveniently, the length of the sides of the container is somewhat less than the height of the tubes, e.g., 10 to 50% less.

The upper surface of the mat of the present invention can be played off with or without placement of a golf tee with a mat of the present invention, a golf tee can be placed anywhere on the upper surface by pushing the tee into the filler material within the honeycomb form support matrix. Where the support matrix is in the form of upright tubes or the like, then the tee may also be inserted between adjacent tubes or into the filler material within the tubes as described.

Where the honeycomb form support matrix is a more or less integrally-formed structure this is conveniently formed from a first series of substantially parallel horizontally extending

panels which intersect and optionally interlock at a predetermined angle with a second series of substantially parallel horizontally extending panels to form a plurality of interstices between the intersecting first and second series of panels. The angle at which the first and second series of panels intersect can be from 15° to 90° relative to each series of panels. The interstices are packed with filler material and/or binder material and for any one or more of the previously mentioned materials or substances according to the present invention. It will be appreciated that the filler material used in this form of the present invention may be as described as above with reference to the tube assembly form of the support matrix.

In another aspect of the present invention there is provided a practice support platform comprising a raised platform with a flat upper surface provided with a player standing area and at least one playing surface area, said at least one playing surface area is provided with one or more recesses formed and arranged for receiving a mat according to the present invention. Preferably, the mat is provided within an outer casing according to the present invention. This has the advantage that the outer casing with the mat therein can be placed into and can be taken out of the recess in the practice platform with the minimum of effort. This provides quick, clean and efficient method of changing the mat whenever required.

The player standing area is typically a rectangular area adjacent the at least one playing surface area. Where two playing surface areas provided, it preferable that the player standing area is located there between such that the upper surface of the platform is divided into three areas.

When the playing surface of the mat becomes too abraded through use, the mat can simply be replaced or alternatively turned upside down and play continued on the other side of the mat where both sides of the support matrix are open. Where only very localized damage has been sustained it may be preferable to remove and replace only those tubes which have been damaged in the case of a tube assembly form support matrix. This can be done by simply cutting out the damaged tubes (if the tubes are bonded to adjacent tubes) and inserting replacement tubes. Water may be added to the replacement tubes after they have been correctly positioned. Where water-swellaable filler material is used this helps to ensure that the tubes expand and pack tight against the surrounding tubes and/or the outer casing where present.

In a yet further aspect of the present invention, where the mat becomes abraded or worn through use or otherwise, a top layer of the mat may be shaved off to present a fresh playing surface. Where an outer casing is used, this may conveniently be provided with a vertically movable base portion which can be used to raise the mat to bring the new playing surface thereof up to or above the sides of the casing. The casing may be provided with a base displacement means such as a jack.

When it is desired to shave off the top layer of the mat the movable base is moved upwardly by the displacement means such that the top layer of the mat is raised and a suitable cutting means may be used to remove the top layer thus leaving a fresh clean, flat and undamaged playing surface.

To fabricate the mats of the present invention with a tube-assembly form support matrix it is envisaged that there may be used machinery formed and arranged for filling essentially continuous tubes with filler material, which continuous filled tubes are then cut into tubes of the desired length(s). The cut filled tubes can then be assembled together into a mat with a bonding step where the cut filled tubes are glued or otherwise attached to adjacent tubes and/or with packing of the cut filled tubes into an outer casing or other container. The mat of the present invention can also in a further embodiment contain one or more coloring agents such as a dyestuff and/or a pigment. Preferably, the mat is colored green by use of the appropriate colored agents.

Further embodiments of the present invention can be envisaged were the mat of the present invention can be used for other sports such as soccer, American football, rugby, tennis, athletics, hockey and the like where the playing characteristics required of the mat differ according to the particular sport. For example in sports such as rugby and American football the mat requires to be robust enough to withstand the relative high pressures and sheer forces applied to the pitches at the points of scrummage. Whereas for soccer pitches and athletics tracks, for example, the mat requires to be relatively more resilient in order that it does not, in use, become too difficult to run and play on.

It is also envisaged that the mat of the present invention can be used to replace areas of heavy wear such as those which frequently occur around the goal-mouths of soccer pitches and the base-line service points on grass tennis courts.

It will be appreciated that it will generally be possible and in many instances particularly desirable, to mix grass seed with the packing material located at or near the upper surface of the mat of the present invention. The mat may then be stored in a suitably dry condition to prevent germination and growth of the grass seed until such times as it is desired to grow the grass.

Additionally or alternatively, the grass seed may be grown by the adding water to the mat and allowing the grass to grow thereon. The growth of grass provides a more natural surface appearance to the mat, and additionally, the grass roots provide additional structural integrity to the mat as a result of inter-locking of the root systems between grasses growing in neighboring tubes.

Where grass seed is provided in the present invention, it would be desirable to include a suitable fertilizer to aid the growth and/or condition of the subsequently grown grass. For example, the fertilizer may be added as a solid or liquid to the packing material.

BRIEF DESCRIPTION OF THE DRAWINGS

Further preferred features and advantages of the present invention will appear from the following detailed description given by way of example of some embodiments illustrated with reference to the accompanying drawings in which:

Fig. 1 shows a container containing a mat according to one aspect of that present invention;

Fig. 2 shows a support platform according to another aspect of the present invention;

Fig. 3 shows a paper tube packed with filler material for use in forming a mat according to the present invention; and

Fig. 4 shows a close up plan view of the mat according to one aspect of the present invention and the possible locations for placement of a golf tee thereon.

DETAILED DESCRIPTION OF THE INVENTION

A mat, as generally indicated by the reference numeral 1, according to the present invention is shown in Fig. 1. The mat 1 is constructed from a large number of close packed upright paper tubes 2, which are glued together along mutually co-operating edges. The tubes are approximately 10 cm. (3.94 inches) in height with a diameter of approximately 2.5 cm. (.984 inches). The tubes 2 are packed with a filler material 4. (see Fig. 3).

The mat 1 is contained in a rectangular container 6 with sides 8 which are approximately 1 cm. (.394 inches) less in height than that of the tubes 2. The container 6 is approximately 25 cm. (9.843 inches) in length and 15 cm. (5.906 inches) in width and the mat 1 is of substantially the same dimensions such that it fits tightly within the container 6.

A raised (approximately 20 cm. (7.874 inches) from the floor to an upper surface) rectangular support platform 10 (see Fig. 2) is provided with a player support area 12 located between two recesses 14. The player support area 12 is rectangular (75 cm. x 60 cm.) (29.528 inches x 23.622 inches) and is provided with a plastic non-slip surface coating.

The recesses 14 on opposing sides of the player support area are rectangular (25 cm. x 75 cm.) (9.843 inches x 29.528 inches) and are formed and arranged to receive a plurality of containers 12. The recesses 14 have a number of locating holes 16 which are formed and for receiving corresponding projections 18 extending from each of the corners of the base of the containers 14 where the containers 14 are placed in the recesses 14 as shown in Fig. 2.

A single tube 2 according to the present invention is shown in Fig. 3. The tube 2 is filled with packing material 4 which is sphagnum moss 20 intimately mixed with wood chips 22.

A plan view of the mat 1 of the present invention indicating the hexagonal close packaging arrangement is shown in Fig. 4. In the pulses hexagonal close packing arrangement each tube (or central tube) is typically surrounded by six other tubes forming a hexagon shape around the central tube. This is the case for every tube except those tubes 2 at the edge or corner of the container 12.

Possible locations for placement of a golf tee (not shown) are indicated by the letters X Y and Z in Fig. 4, wherein X is located on the top of a tube 2; Y is an interstice as defined by three neighboring tubes in the hexagonal close packed formation; and Z is defined as the region between two neighboring tubes. It will of course be appreciated that X, Y and Z are not intended to be limiting on the possible locations for placement of a golf tee and that the flexible nature of the mat 1 allows a golf tee to be placed substantially anywhere thereon.

Example

In one embodiment of the present invention, the tubes are formed from sheets of newspaper cut to the required size and rolled, then taped (with adhesive tape) into the form of a cylinder with a diameter of about 12 to 16 mm (.472 inches to .630 inches) and a height of about 12 cm. (4.724 inches). The tubes were packed (by hand) with commercially available peat moss (the composition of which is given below). A number of the thus formed tubes were close packed upright into an open top container with sides of length and breadth of 20 cm. (7.87 inches) by 15 cm. (5.91 inches) and a depth of 12 cm. (4.73 inches).

The composition of the packing material was determined as follows: The packing material (100 g.) (.220 pounds) was heated in a domestic oven at 40° C. (104 Fahrenheit) for 12 hours after which time the weight of dry material recovered was 47 g. (.104 pounds); which is equivalent to the packing material comprising 53 wt.% water and 47 wt.% dry material.

The recovered dry material (47 g) (.104 pounds) was then roasted in air on an open metal plate heated by a Bunsen burner for approximately 45 minutes to remove the organic matter thereof. The material recovered after roasting weighed 18 g. (.039 pounds), and was designated as being mainly inorganic material. The dry material was therefore determined to comprise: 62 wt.% organic material and 38 wt.% inorganic material.

The density of the uncompressed packing material as originally obtained commercially was determined by placing 100 g. (.220 pounds) of the packing material into a volumetric measuring cylinder which was firmly tapped around its outer surfaces to ensure the packing

material was properly settled in the measuring cylinder. The volume occupied by the packing material was read off from the measuring cylinder. The density was simply calculated thereafter as grams of material per cm^3 occupied by the material.

The density of packing material before drying was 0.52 g.cm^{-3} ($32.459 \text{ pound/ ft.}^{-3}$) (100 cm^3 (6.102 cubic inches) packing material has a volume of 192 cm^3 (11.72 cubic inches); the density of the dried (at 40° C. (104 F.) packing material was 0.625 g.cm^{-3} ($39.0137 \text{ pound/ ft.}^{-3}$) (100 g. (.220 pounds) dried material had a volume of 160 cm^3 (9.76 cubic inches); the density of the inorganic (roasted) material is 2.50 g.cm^{-3} ($156.055 \text{ pound/ ft.}^{-3}$) (100 g of the roasted material had a volume of 40 cm^3).

The large volume of dried material is due mainly to the presence at relatively large particles of soil with correspondingly large air spaces there between. The dry material (and the moist packing material) had relatively large air spaces between the material particles, which in turn is representative of a well aerated soil, which is particularly suited to use as a golf teeing off surface due to the inherent resilience provided by the material.

The particle size of the dry material was determined by passing a known weight of the dry material through a series of sieves with known mesh sizes. The particle size distribution (as wt.%) of the dry material was:

9 - 2 mm. (0.354 inches- 0.078 inches) = 47 wt.%; 2 - 1 mm. (0.078 inches to 0.03937 inches) = 21 wt.%; $\geq 5 \text{ mm.}$ (0.197 inches) = 6.0 wt.%; $< 5 \text{ mm.}$ (0.197 inches) = 26 wt.%.
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Various modifications may be made to the above-described embodiments without departing from the scope of the present invention.

For the production of the mats the system of tubes could be modified into a glued section forming a matrix, which is fitted into a frame or box of cardboard, wood, plastic, metal or any combination of these materials and or any other suitable material. The outer tubes of the matrix are attached to the wall of the box by stapling, gluing, stitching or any other appropriate physical or mechanical means. The tubes may or not be attached to the base of the container as required. This method of stretching and attaching the matrix of tubes to the wall of the container holds the openings of the tubes patent to facilitate the filling of the tubes.

The tubes forming the matrix can vary in diameter and length and the thickness of the material from which they are formed as can the type of material, paper, plastic, woven fabrics or any other suitable material. This allows for the construction of different mats varying in size, strength and configuration specific for the purpose of its function.

The tubes used may have holes or perforations in their walls at a diameter and frequency of spacing to facilitate even, lateral distribution of the filler material and in those mats sown with grass seed to allow for lateral growth of roots between the tubes to strengthen and bind the mat and ensure the grass turf produced on germination and growth is securely bound to the mat structure.

The frame, box or container may be lined on the outer surface, inner surface or both surfaces as required. The lining material could be plastic, sheets of plastic, woven material of natural and or man made fibers. The lining could be porous or non-porous to water.

The walls, the base or both may be perforated with holes the size and frequency of distribution may vary to allow drainage of water in different conditions.

The sides and base of the box/container could be strengthened with strips or ribs of corrugated cardboard, plastic, wood, metal or any other suitable material to facilitate its structural integrity in use, handling, and storage. These strengthening ribs could be attached to the structure of the box or in pockets in any lining, if so used.

It is envisaged that one method of producing the mat is to place the empty box with matrix attached on a conveyer which will pass under a storage hopper which will dispense known volume of dry filler material on to the boxes upper surface. This volume of filler will over fill the tubes and lie on the upper surface of the tubes and mat to a known thickness required for the desired compactness and depth of the tubing. The tray or box will be vibrated to ensure the uniform filling of the tubes. The remaining known layer not entering the tubes by vibration will be compacted into the tubes by mechanical tamping or rolling this layer.

By experiment the pressure exerted by tamping or rolling will vary according to the density or compactness required in the tubing. The excess filler material will be brushed off the mat, for re-use. The filler material will conform to the specification required for the purpose and use of the mat. The mats will be wrapped, packed and stored.

The size of mat both in depth and surface area can vary. Surface area from 0.1 square meters (1.076 square feet) or less to 2 square meters (21.28 square feet) or more. Depth of mat from 2 centimeters (0.787 inches) or less 40 centimeters (15.748031 inches) or more, as required for their purpose.

It is envisaged that in mats constructed on which grass seed is sown, for the growth of turf, the walls comprising the sides of the container could be 2 centimeters (0.787 inches) higher than the tubes comprising the matrix to form a lip and container for the seedbed in which the grass will grow. It is envisaged that the dry filler material dispensed via the storage hopper could be replaced with a semi-dry soil/paper mache mixture. The method of construction would be the same as previously described. However, the mats once constructed would pass by conveyor belt through a continuous oven to remove moisture prior to wrapping and packing. The use of paper mache in the construction of the mat gives the advantage of greater cohesion and binding of the soil particles therefore providing added strength and durability of the mat.

It is envisaged that the paper mache to be used is provided by mechanically mixing in the ratio 20 gram (0.705 ounces) of newsprint with 1 liter (1.32 gallons) of water. The temperature of the water can vary from 0 degrees Centigrade (32 Fahrenheit) to 100 degrees Centigrade (212 Fahrenheit). The paper can be used as large sheets of newsprint or shredded newsprint. The newsprint can be new or recycled. The ratio of the dry weight of newsprint to water can vary. Decreasing the weight of newsprint or increasing the volume of water and thorough mixing gives

paper mache or finer fiber separation but has less cohesive and adhesive properties. The converse is true.

Typically the material used in the composition of mats is in the ratio of volume of 5 liter (1.32 gallons) of paper mache to 5 liter (1.32 gallons) of soil component. The paper mache and soil is thoroughly mixed and the excess water strained out by compression through a fine metal sieve. The soil content mixed with the paper mache can vary from inorganic sand and clay to organic composts and peat. The percentage proportions of each can vary from 100% to nil, according to the properties required of the mat for the type of club and golf shot to be practiced.

In some cases various plastics can be mixed with the paper mache such as polystyrene in the form of spheres of various sizes and shapes to form a material which exhibits similar properties to paper mache/soil mat.

The paper mache can be replaced by a system of natural fibers, wool, hair, plant fiber or man made fibers of plastic or any other suitable fiber, and natural glues or adhesives and manufactured glues and adhesives to form a mixture to replace the paper mache mixture.

The paper mache mixture can be used by mixing with the above-described mixtures in varying proportions.

A mat can be produced without using a matrix of tubes using a paper mache and soil mixture. These mats do not exhibit the strength or durability of the mats containing the matrix of tubing but have the advantage being for the use by an individual golfer and being of a disposable nature.

It is envisaged that one method of production would be to mix the paper mache and soil as described, remove the excess water by mechanical straining and compression, remix the resultant mixture and place in cardboard or paper mache boxes of the dimensions of 30 cm. (11.81 inches) square and 4 cm. (1.58 inches) square depth. The mixture is tamped and rolled and then passed through continuous dry ovens to remove moisture then wrapped, packed and stored. It is also envisaged that the mats could be produced by mixing the soil and paper mache, straining removing excess water, remixing then extruding this dryer mixture through a dye to give a continuous sheet of 30 cm. (11.81 inches) width by 4 cm. (1.58 inches) depth. The dimension can be altered to give mats of different sizes as required.

The extruded continuous mat is rolled to give uniform thickness and passed through a continuous dry oven. The matting can be cut into the required length either prior to or after drying. A plastic or cardboard edging can be wrapped around the side for added protection and strength in handling, package and storage. The dry mats are wrapped, packed and stored.

It is envisaged that a method of production for the paper mache soil mats would be by vacuum forming over a form or template. This can be done to form discrete mats of various sizes but typically of 30 cm. (11.81 inches) width, 30 cm. (11.81 inches) length 30cm. and 4cm. (1.57 inches) depth. The mats would be rolled to give uniform thickness and passed through by conveyor in a continuous drying oven. Vacuum forming could also produce continuous roll of matting which could be cut into discrete mats prior to or after drying the mixture content. The moisture content, after drying, of the mats can vary from virtually nil, for storage, to a moisture

content allowing immediate use. Dry mats would be re-hydrated with a known quantity of water prior to their use.

A mat of low adhesive properties of their component parts can be produced by mixing organic compost or peat with a high plant fiber content with known quantity of water, mixing thoroughly and forming into mat as described in production method for the paper mache mats described on pages 28 and 29.

A mat consisting of only paper mache can be formed. The compactness of this can be varied by the pressure exerted by rolling or the vacuum force used in its production. High pressure producing a compact mat with few air spaces between the fibers. Low pressure less compact softer mat with many more airspaces between the paper mache fibers. The mats would be formed by production for paper mache mats as described on pages 28 and 29, or by any other suitable means.

It is envisaged that the paper mache soil mixture can be utilized to form a mat without using a matrix of tubes. It does not have the integral strength and durability of a mat formed with the matrix of tubes but could be utilized to form a mat with a limited lifespan and of a more disposable nature. This allows the production of mats with different soil consistencies which allow the practice with wide range of golf clubs and golf shots, especially the more lofted clubs which can take large divots and may cause substantial damage to the mat with less experienced golfers. However, this would not cause a problem as the mat could be purchased and used by a individual golfer.

CLAIMS

1. A mat suitable for use as a playing surface, the mat comprising a support matrix and a filler material.
2. The mat as claimed in claim 1, wherein the support matrix comprises paper-mache.
3. The mat as claimed in claim 1, wherein the support matrix comprises an array of close-packed tubes that are packed with the filler material.
4. The mat as claimed in claim 3, wherein the tubes are formed from a porous material.
5. The mat as claimed in claim 3, wherein adjacent tubes are attached to one another.
6. The mat as claimed in claim 3, wherein the tubes have lateral perforations.
7. The mat as claimed in claim 1, wherein the filler material comprises at least one filler material selected from the group consisting of paper-mache, sand, grit, polymer beads, soil, loam, sphagnum moss, peat, wood chips or shavings, sawdust, and clay.
8. The mat as claimed in claim 1, wherein the filler comprises a fibrous material.
9. The mat as claimed in claim 1, wherein the mat is seeded with grass.
10. A method of making a mat for use as a playing surface, the method comprising adding a filler material to a support matrix, and heating or drying the support matrix and filler material.

ABSTRACT

A rectangular mat on which the surface is used for the germination and growth of grass seed to produce turf mat to replace worn or damages grass sports/recreational surfaces and/or a mat to be used as a surface from which to hit golf balls.

Preliminary Amendment
Inventor: Burns, John Granville
Attorney Docket No.: 717901.19

REMARKS


Attached hereto is a marked-up version of the changes made to the specification and claims by the current amendment. The attached page is captioned "VERSION WITH MARKINGS TO SHOW CHANGES MADE".

Applicant has amended the specification and abstract to comport with United States Patent and Trademark Office Rules. In addition, Applicant has amended the claims to eliminate multiple dependency and to comport with U.S. practice, which is totally unrelated to patentability. No new matter is added.

In view of the above, it is respectfully believed that all the presently submitted claims are allowable and a Formal Notice of Allowance is courteously solicited. It is believed that the application is in condition for allowance, however, if the Examiner feels otherwise, a telephone interview is respectfully requested. An early notice of allowance is solicited.

Respectfully submitted,

Date: December 21, 2001



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Preliminary Amendment
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Attorney Docket No.: 717901.19

VERSION WITH MARKINGS TO SHOW CHANGES MADE

Following is a marked-up version of the Specification with all changes shown by
conventional comparison (underlining and bracketing):

717901.19 Burns, John Granville

PLAYING SURFACE SUBSTRATE, IN PARTICULAR TURF MATS

TECHNICAL FIELD

The present invention relates to a substrate material for use as a playing surface. In particular, the substrate material is for use as a playing surface substrate for [practising] practicing and/or playing golf.

BACKGROUND OF THE INVENTION

To facilitate learning or [practising] practicing the game of golf it is common to use the facilities provided at a golf driving range. Golf driving ranges generally provide practice areas provided with practice mats. Typically, the practice mats are rectangular in shape and are formed arranged to provide a player standing area and at least one or more pre-set location for placement of golf tees.

The practice mats are generally placed on the floor of the driving range, which is typically made from concrete or some other similar substance which is hard and non-resilient. In addition to the foregoing there are also commercially available relatively expensive practice mats. These mats are generally provided on raised support platforms which are formed from a rigid plastic material or wood.

It has been found that repeated playing off on practice areas of the [abovementioned] above-mentioned types can lead to various repetitive stress injuries similar to tennis elbow.

These injuries are generally caused by the inadvertent striking of the more or less hard non-resilient playing surface of the practice mat/block with the [golf-club] golf club. The resulting jarring effect is transmitted to the joints (particularly the elbow and shoulder joints) of the player. Repeated jarring of the type has been found to result in injury to the connective tissue in and/or around the affected joints.

Practice mats/platforms of this type allow the player to practice and/or learn only a limited range of strokes Only those strokes which require the golf ball to be resting on a tee or those strokes which do not require the club to strike the underside of the golf ball (for example, when putting back spin onto a golf ball) can be [practised] practiced. Playing strokes of the type which require the club to strike the underside of the golf ball greatly increases the possibility of the club striking the practice mat, and so increase the likelihood of injury to the player.

It is also a particular feature of these practice mats that there is only a limited number of pre-selected locations for placement of tees. This limitation of the restricted number and locations for placement of tees does not suit all of the many individual playing styles or the different statures of individuals wishing to use the practice mats/platforms.

SUMMARY OF THE INVENTION

It is an object of the present invention to avoid or [minimise] minimize one or more of the foregoing disadvantages.

The present invention is directed towards the provision of a mat suitable for use as a playing surface which is flexible, resilient and can deform more or less like natural turf or grass under the impact of a golf club. The mat is also robust enough to be walked upon without sustaining damage to the mat.

In a first aspect of the present invention, there is provided a mat suitable for use as a playing surface and comprises a honeycomb form support matrix packed with a filler material. The support matrix may be in the form of a more or less integrally-formed structures or conveniently is in the form of a close packed assembly of substantially upright tubes packed with filler material.

The tubes are generally formed from a reasonably flexible and deformable material to facilitate close packing thereof and enable the mat to yield under the impact of for example, a golf club. Suitable materials that may be mentioned include one or more of: plastics film or sheeting which is preferably biodegradable, paper, cardboard, and textile sheet materials of natural or synthetic [fibres] fibers which may be woven or non-woven. Furthermore, the material used to [fabricated] fabricate the tubes may be porous or non-porous. It would be particularly desirable to choose a material which is porous to facilitate the movement of moisture (or excess water) into and out of the tubes thereby avoiding for example water-logging of the mat in wet conditions or in the case of over-watering.

The tubes are preferably generally cylindrical in shape, however they may be square, rectangle, elliptical or polygonal in section. Typically, the tubes are packed in a hexagonal close

packed configuration. [Alternatively] Alternatively, the tubes are arranged in a less closely packed arrangement such as a square close packed configurations. It will also be appreciated that with tubes of a generally flexible material, the tubes may be deformed to a greater or lesser extent resulting in even closer packing together.

Typically, the tubes have a diameter of from 0.5 cm. (.197 inches) to 10 cm. (3.94 inches), preferably from 1 cm. (.394 inches) to 5 cm. (1.97 inches) and most preferably from 1 cm. (.394 inches) to 3 cm. (1.181 inches). The tubes typically have a height of from 3 cm. (1.181 inches) to 25 cm. (9.84252 inches), preferably from 5 cm. (1.97 inches) to 15 cm. (5.91 inches) and most preferably from 5 cm. (1.97 inches) to 10 cm. (3.94 inches). It will of course be [realised] realized that these dimensions can be altered and varied according to particular requirements. Furthermore, it is also envisaged that tubes of different diameters may be present within the mat. In this case the arrangement of the tubes may be regular as above or it may be more random to accommodate the different sizes of tubes more efficiently. The tubes may also be closed at the bottom end portion to provide a tube which is open only at the top portion.

Adjacent tubes in the mat may be bonded or otherwise attached together at one or more shared edges or sides of said adjacent tubes. Preferably the tubes are glued together along the mutually co-operating edges or sides. The bonding of the tubes together has the beneficial effect of providing additional strength and robustness to the mat. Furthermore, bonding the tubes together allows easier handling and placement in use of the mat.

The filler material is generally packed into the tubes sufficiently tightly so that the filler material resists falling out of the tubes when the mat is being [manoeuvred] maneuvered or otherwise handled. On the other hand, it is normally desirable to avoid excessively tight packing that could result in compaction of the filler and loss of resilience in the playing surface. Suitable packing conditions may be readily determined by simple trial and error.

Once packed with filler material, the tubes may optionally be sealed to provide a tube which is closed at the top and/or bottom portions. It is particularly desirable to seal the tubes where a material is used which is more prone to falling out of the tubes when the mat is being [manoeuvred] maneuvered or otherwise handled. Filler materials with little or no interlocking capacity such as sand, grit, polymer beads or chips and the like are examples of such filler materials.

The integrally-formed or close packed assembly structure of the mat allows easy handling by being in the form of a continuous layer of support matrix.

The mat of the present invention generally provides a playing surface more representative of natural turf and grass surfaces found on golf courses than the currently available golf practice mats/platforms. The mat has more naturally deformable properties due to the use of the filler material, in addition to reasonable structural stability, in use, (to lateral and vertically applied forces) when a golf club strikes the mat, when a player stands on the mat, and/or for the placement of golf tees. Furthermore, in use, when a player strikes the mat with a golf club, the mat deforms under the impact of the club in a manner very similar to natural turf or grass

surfaces, with a reduced possibility of injury to the player over that of the prior art practice mats/platforms. The [abovementioned] above-mentioned advantageous properties of the mat allow a player to play a wider range of strokes than is possible with currently available practice mats/platforms.

The filler material can be chosen to mimic the properties of a particular golf course or any other desired playing surface. To achieve this, the filler material conveniently comprises at least one of, the following materials: soil such as various types of loam, sphagnum moss, peat, wood chips/shavings, sawdust, clay, sand, polymer chips/beads/fragments and [papier] paper mache. Where a filler material [is for example] is, for example, very [fibrous] fibrous, it will have a large number of interconnected and/or interwoven [fibres] fibers which provide a [stabilising] stabilizing network within which it is possible to incorporate further non-fibrous or fibrous filler materials. The choice of filler material providing the [stabilising] stabilizing network of [fibres] fibers, may be varied to adjust or modify the density of interconnected and/or interwoven [fibres] fibers to provide a range of different [stabilising] stabilizing effects. For example, where a further filler material such as sand (which has little or no interlocking properties) is used, it may be necessary to use a filler material with a relatively high content and density of interconnected and/or interwoven [fibres] fibers to prevent the sand from settling at the bottom of the support matrix, in order to maintain a uniform distribution of sand and fibrous filler material throughout the support matrix.

Where substantially non-absorbent and/or non-water swellable filler material is used e.g. sand, certain polymer chips/beads (it will be appreciated that some types of polymer chips/beads will be water absorbent and/or water swellable), it would generally be desirable also to include one or more other filler materials which are water absorbent and/or expandable (e.g. woodchips, sawdust, and sphagnum moss), depending upon the desired playing properties required of the mat.

It will be appreciated that materials such as loam are available with a wide variety of properties and textures and for example may be peaty, fibrous or non-fibrous or clay-like. The [abovementioned] above-mentioned filler materials are not intended to be exhaustive, but merely illustrative of the types of filler material which may be used in accordance with the present invention.

The filler material (within the mat) may be used in either a wet or dry condition. It would generally be more convenient to have the filler material in the dry state for transportation of the mats in order to [minimise] minimize carriage costs and facilitate handling of the mats. Once installed, the filler material can have water added thereto if so desired. Where it is desirable for the filler material in the mat to be in a wet/damp condition prior to installation it is desirable to use a support matrix which is resistant to the effects (such as rotting and tearing) of long term exposure to damp or humid conditions. The filler material and/or the material from which the material are fabricated, can also be admixed or treated with one or more additives to prevent

[mould] mold or fungus (or other similar conditions) growing thereon through exposure to water or damp conditions.

It will be appreciated that the packing material will generally have a certain moisture content sufficient to prevent excessive or unwanted settlement thereof when in a non-use condition. This moisture content will of course vary from material to material and can readily be determined by simple experimentation.

The filler material within the tubes is preferably dry when the mat is being stored in a non-use condition. In this way the mat is relatively light and easy to [manoeuvre] maneuver. Before use, water can be added to the filler material. The water generally causes the material to swell and/or become heavier and therefore becomes more tightly bound within the tubes and any supporting frame or container. The amount of water added to the mat in addition to the composition of the particular playing surface filler material can be varied to suit whichever playing surface condition(s) is desired to be mimicked, thereby increasing the variety and number of conditions available to play or practice on.

Preferably or alternatively, there may be used a binder material (in combination of the [abovementioned] above-mentioned filler materials) which contains one or more additives which are capable of forming a semi-interpenetrating network (semi-IPN) or interpenetrating network (IPN) within the tube. The binder material can be used to bind together one or more filler materials that have little or no interlocking ability as described previously herein.

The use of a binder material allows the use of materials which would not normally be considered for use as such due to the lack of sufficient interlockability and/or being too dense and/or not being dense enough.

Binder materials are generally those which are not solvents for the filler material, and may be formed from one or a mixture of polymerisable monomers and/or polymers. Suitable monomers and/or polymers are preferably those capable of forming polyolefins and may be thermoplastic or thermosetting. When polyfunctional monomers and/or polymers are used, then a continuous cross-linked polymer system can be formed from the monomer and/or polymer. A semi-IPN is obtained when one of the co-continuous systems (i.e. the pre-existing polymer) is cross-linked. When both systems (i.e. the pre-existing polymer and the polymerised monomer) are cross-linked, an IPN is formed. The formation of a semi-IPN/IPN within the tube also provides additional structural stability to the mat as a whole, in addition to helping to retain other filler materials in the tube.

The additive which forms the semi-IPN/IPN may be one, or a mixture or more than one, type of monomer which is polymerisable to form said semi-IPN/IPN. The polymerisation of the monomer(s) is preferably effected within the tubes prior to use of the mat. The polymerisation is preferably ionic, most preferably cationic.

Desirably urea and formaldehyde are co-monomers, which are polymerised to form a co-polymer. The urea and formaldehyde are co-polymerised by the addition of an acidic catalyst solution to the monomers.

Alternatively or desirably, [papier] paper maché may be mixed with binder or filler material and the [papier] paper maché, when set, provides further structural stability to the mat in addition to altering the mat playing characteristics.

The amount of [papier] paper maché and/or the amount of binder can be varied to achieve the desired balance of structural support and playing characteristics. This can be done as a matter off simple experimentation to achieve the desired results. For example, in packing material comprising [papier] paper maché and peaty loam, to increase the structural support provided by the packing material it is desirable to increase the proportion of [papier] paper maché relative to the peaty loam. To increase the resilience of the packing material it is desirable to increase the proportion of peaty loam relative to the [papier] paper maché.

Preferably, the filler material and the mat are derived from a material(s) which is (are) biodegradable or have previously been biodegraded and/or may be recycled for re-use as a filling material or other component of the present invention.

Conveniently, the mat is provided with an outer casing generally in the form of an open-top container with a base and sides inside which is more or less tightly packed said assembly of tubes packed with filler material. The container may be fabricated from plastic, metal, wood, cardboard or any combination of the foregoing. The base and/or sides may be provided with one or more holes to aid drainage therefrom.

The outer casing helps to maintain the structural integrity of the close packed tube assembly in use and during handling and facilities transport and/or storage of the mats.

Preferably, the sides of the container are no deeper than the height of the tubes of the surface playing material. Conveniently, the length of the sides of the container is somewhat less than the height of the tubes, e.g., 10 to 50% less.

The upper surface of the mat of the present invention can be played off with or without placement of a golf tee with a mat of the present invention, a golf tee can be placed anywhere on the upper surface by pushing the tee into the filler material within the honeycomb form support matrix. Where the support matrix is in the form of upright tubes or the like, then the tee may also be inserted between adjacent tubes or into the filler material within the tubes as described.

Where the honeycomb form support matrix is a more or less integrally-formed structure this is conveniently formed from a first series of substantially parallel horizontally extending panels which intersect and optionally interlock at a predetermined angle with a second series of substantially parallel horizontally extending panels to form a plurality of interstices between the intersecting first and second series of panels. The angle at which the first and second series of panels intersect can be from 15° to 90° relative to each series of panels. The interstices are packed with filler material and/or binder material and for any one or more of the previously mentioned materials or substances according to the present invention. It will be appreciated that the filler material used in this form of the present invention may be as described as above with reference to the tube assembly form of the support matrix.

In another aspect of the present invention there is provided a practice support platform comprising a raised platform with a flat upper surface provided with a player standing area and at

least one playing surface area, said at least one playing surface area is provided with one or more recesses formed and arranged for receiving a mat according to the present invention. Preferably, the mat is provided within an outer casing according to the present invention. This has the advantage that the outer casing with the mat therein can be placed into and can be taken out of the recess in the practice platform with the minimum of effort. This provides quick, clean and efficient method of changing the mat whenever required.

The player standing area is typically a rectangular area adjacent the at least one playing surface area. Where two playing surface areas provided, it preferable that the player standing area is located there between such that the upper surface of the platform is divided into three areas.

When the playing surface of the mat becomes too abraded through use, the mat can simply be replaced or alternatively turned upside down and play continued on the other side of the mat where both sides of the support matrix are open. Where only very [localised] localized damage has been sustained it may be preferable to remove and replace only those tubes which have been damaged in the case of a tube assembly form support matrix. This can be done by simply cutting out the damaged tubes (if the tubes are bonded to adjacent tubes) and inserting replacement tubes. Water may be added to the replacement tubes after they have been correctly positioned. Where water-swellaable filler material is used this helps to ensure that the tubes expand and pack tight against the surrounding tubes and/or the outer casing where present.

In a yet further aspect of the present invention, where the mat becomes abraded or worn through use or otherwise, a top layer of the mat may be shaved off to present a fresh playing surface. Where an outer casing is used, this may conveniently be provided with a vertically movable base portion which can be used to raise the mat to bring the new playing surface thereof up to or above the sides of the casing. The casing may be provided with a base displacement means such as a jack.

When it is desired to shave off the top layer of the mat the movable base is moved upwardly by the displacement means such that the top layer of the mat is raised and a suitable cutting means may be used to remove the top layer thus leaving a fresh clean, flat and undamaged playing surface.

To fabricate the mats of the present invention with a tube-assembly form support matrix it is envisaged that there may be used machinery formed and arranged for filling essentially continuous tubes with filler material, which continuous filled tubes are then cut into tubes of the desired length(s). The cut filled tubes can then be assembled together into a mat with a bonding step where the cut filled tubes are glued or otherwise attached to adjacent tubes and/or with packing of the cut filled tubes into an outer casing or other container. The mat of the present invention can also in a further embodiment contain one or more [colouring] coloring agents such as a dyestuff and/or a pigment. Preferably, the mat is [coloured] colored green by use of the appropriate [colouring] colored agents.

Further embodiments of the present invention can be envisaged were the mat of the present invention can be used for other sports such as soccer, American football, rugby, tennis, athletics, hockey and the like where the playing characteristics required of the mat differ according to the particular sport. For example in sports such as rugby and American football the mat requires to be robust enough to withstand the relative high pressures and [shear] sheer forces applied to the pitches at the points of scrimmage. Whereas for soccer pitches and athletics tracks, for example, the mat requires to be relatively more resilient in order that it does not, in use, become too difficult to run and play on.

It is also envisaged that the mat of the present invention can be used to replace areas of heavy wear such as those which frequently occur around the goal-mouths of soccer pitches and the base-line service points on grass tennis courts.

It will be appreciated that it will generally be possible and in many instances particularly desirable, to mix grass seed with the packing material located at or near the upper surface of the mat of the present invention. The mat may then be stored in a suitably dry condition to prevent germination and growth of the grass seed until such times as it is desired to grow the grass.

Additionally or alternatively, the grass seed may be grown by the adding water to the mat and allowing the grass to grow thereon. The growth of grass provides a more natural surface appearance to the mat, and additionally, the grass roots provide additional structural integrity to the mat as a result of inter-locking of the root systems between grasses growing in [neighbouring] neighboring tubes.

Where grass seed is provided in the present invention, it would be desirable to include a suitable [fertiliser] fertilizer to aid the growth and/or condition of the subsequently grown grass. For example, the [fertiliser] fertilizer may be added as a solid or liquid to the packing material.

BRIEF DESCRIPTION OF THE DRAWINGS

Further preferred features and advantages of the present invention will appear from the following detailed description given by way of example of some embodiments illustrated with reference to the accompanying drawings in which:

Fig. 1 shows a container containing a mat according to one aspect of that present invention;

Fig. 2 shows a support platform according to another aspect of the present invention;

Fig. 3 shows a paper tube packed with filler material for use in forming a mat according to the present invention; and

Fig. 4 shows a close up plan view of the mat according to one aspect of the present invention and the possible locations for placement of a golf tee thereon.

DETAILED DESCRIPTION OF THE INVENTION

A mat, as generally indicated by the reference numeral 1, according to the present invention is shown in Fig. 1. The mat 1 is constructed from a large number of close packed

upright paper tubes 2, which are glued together along mutually co-operating edges. The tubes are approximately 10 cm. (3.94 inches) in height with a diameter of approximately 2.5 cm. (.984 inches). The tubes 2 are packed with a filler material 4. (see Fig. 3).

The mat 1 is contained in a rectangular container 6 with sides 8 which are approximately 1 cm (.394 inches) less in height than that of the tubes 2. The container 6 is approximately 25 cm. (9.843 inches) in length and 15 cm. (5.906 inches) in width and the mat 1 is of substantially the same dimensions such that it fits tightly within the container 6.

A raised (approximately 20 cm. (7.874 inches) from the floor to an upper surface) rectangular support platform 10 (see Fig. 2) is provided with a player support area 12 located between two recesses 14. The player support area 12 is rectangular (75 cm. x 60 cm.) (29.528 inches x 23.622 inches) and is provided with a plastic non-slip surface coating.

The recesses 14 on opposing sides of the player support area are rectangular (25 cm. x 75 cm.) (9.843 inches x 29.528 inches) and are formed and arranged to receive a plurality of containers 12. The recesses 14 have a number of locating holes 16 which are formed and for receiving corresponding projections 18 extending from each of the corners of the base of the containers 14 where the containers 14 are placed in the recesses 14 as shown in Fig. 2.

A single tube 2 according to the present invention is shown in Fig. 3. The tube 2 is filled with packing material 4 which is sphagnum moss 20 intimately mixed with wood chips 22.

A plan view of the mat 1 of the present invention indicating the hexagonal close packaging arrangement is shown in Fig. 4. In the pulses hexagonal close packing arrangement

each tube (or central tube) is typically surrounded by six other tubes forming a hexagon shape around the central tube. This is the case for every tube except those tubes 2 at the edge or corner of the container 12.

Possible locations for placement of a golf tee (not shown) are indicated by the letters X Y and Z in Fig. 4, wherein X is located on the top of a tube 2; Y is an interstice as defined by three [neighbouring] neighboring tubes in the hexagonal close packed formation; and Z is defined as the region between two [neighbouring] neighboring tubes. It will of course be appreciated that X, Y and Z are not intended to be limiting on the possible locations for placement of a golf tee and that the flexible nature of the mat 1 allows a golf tee to be placed substantially anywhere thereon.

Example

In one embodiment of the present invention, the tubes are formed from sheets of newspaper cut to the required size and rolled, then taped (with adhesive tape) into the form of a cylinder with a diameter of about 12 to 16 mm (.472 inches to .630 inches) and a height of about 12 cm. (4.724 inches). The tubes were packed (by hand) with commercially available peat moss (the composition of which is given below). A number of the thus formed tubes were close packed upright into an open top container with sides of length and breadth of 20 cm. (7.87 inches) by 15 cm. (5.91 inches) and a depth of 12 cm. (4.73 inches).

The composition of the packing material was determined as follows: The packing material (100 g.) (.220 pounds) was heated in a domestic oven at 40° C. (104 Fahrenheit) for 12

hours after which time the weight of dry material recovered was 47 g. (.104 pounds); which is equivalent to the packing material comprising 53 wt.% water and 47 wt.% dry material.

The recovered dry material (47 g) (.104 pounds) was then roasted in air on an open metal plate heated by a Bunsen burner for approximately 45 minutes to remove the organic matter thereof. The material recovered after roasting weighed 18 g. (.039 pounds), and was designated as being mainly inorganic material. The dry material was therefore determined to comprise: 62 wt.% organic material and 38 wt.% inorganic material.

The density of the uncompressed packing material as originally obtained commercially was determined by placing 100 g. (.220 pounds) of the packing material into a volumetric measuring cylinder which was firmly tapped around its outer surfaces to ensure the packing material was properly settled in the measuring cylinder. The volume occupied by the packing material was read off from the measuring cylinder. The density was simply calculated thereafter as grams of material per cm^3 occupied by the material.

The density of packing material before drying was 0.52 g.cm^{-3} ($32.459 \text{ pound/ ft.}^{-3}$) (100 cm^3 (6.102 cubic inches) packing material has a volume of 192 cm^3 (11.72 cubic inches)); the density of the dried (at 40° C. (104 F.) packing material was 0.625 g.cm^{-3} ($39.0137 \text{ pound/ ft.}^{-3}$) (100 g.(.220 pounds) dried material had a volume of 160 cm^3 (9.76 cubic inches)); the density of the inorganic (roasted) material is 2.50 g.cm^{-3} ($156.055 \text{ pound/ ft.}^{-3}$) (100 g of the roasted material had a volume of 40 cm^3).

The large volume of dried material is due mainly to the presence at relatively large particles of soil with correspondingly large air spaces [therebetween] there between. The dry material (and the moist packing material) had relatively large air spaces between the material particles, which in turn is representative of a well aerated soil, which is particularly suited to use as a golf teeing off surface due to the inherent resilience provided by the material.

The particle size of the dry material was determined by passing a known weight of the dry material through a series of sieves with known mesh sizes. The particle size distribution (as wt.%) of the dry material was:

9 - 2 mm. (0.354 inches- 0.078 inches) = 47 wt.%; 2 - 1 mm. (0.078 inches to 0.03937 inches) = 21 wt.%; \geq 5 mm. (0.197 inches) = 6.0 wt.%; $<$ 5 mm. (0.197 inches) = 26 wt.%.

Various modifications may be made to the above-described embodiments without departing from the scope of the present invention.

For the production of the mats the system of tubes could be modified into a glued section forming a matrix, which is fitted into a frame or box of cardboard, wood, plastic, metal or any combination of these materials and or any other suitable material. The outer tubes of the matrix are attached to the wall of the box by stapling, gluing, stitching or any other appropriate physical or mechanical means. The tubes may or not be attached to the base of the container as required. This method of stretching and attaching the matrix of tubes to the wall of the container holds the openings of the tubes patent to facilitate the filling of the tubes.

The tubes forming the matrix can vary in diameter and length and the thickness of the material from which they are formed as can the type of material, paper, plastic, woven fabrics or any other suitable material. This allows for the construction of different mats varying in size, strength and configuration specific for the purpose of its function.

The tubes used may have holes or perforations in their walls at a diameter and frequency of spacing to facilitate even, lateral distribution of the filler material and in those mats sown with grass seed to allow for lateral growth of roots between the tubes to strengthen and bind the mat and ensure the grass turf produced on germination and growth is securely bound to the mat structure.

The frame, box or container may be lined on the outer surface, inner surface or both surfaces as required. The lining material could be plastic, sheets of plastic, woven material of natural and or man made [fibres] fibers. The lining could be porous or non-porous to water.

The walls, the base or both may be perforated with holes the size and frequency of distribution may vary to allow drainage of water in different conditions.

The sides and base of the box/container could be strengthened with strips or ribs of corrugated cardboard, plastic, wood, metal or any other suitable material to facilitate its structural integrity in use, handling, and storage. These strengthening ribs could be attached to the structure of the box or in pockets in any lining, if so used.

It is envisaged that one method of producing the mat is to place the empty box with matrix attached on a conveyer which will pass under a storage hopper which will dispense

known volume of dry filler material on to the boxes upper surface. This volume of filler will over fill the tubes and lie on the upper surface of the tubes and mat to a known thickness required for the desired compactness and depth of the tubing. The tray or box will be vibrated to ensure the uniform filling of the tubes. The remaining known layer not entering the tubes by vibration will be compacted into the tubes by mechanical tamping or rolling this layer.

By experiment the pressure exerted by tamping or rolling will vary according to the density or compactness required in the tubing. The excess filler material will be brushed off the mat, for re-use. The filler material will conform to the specification required for the purpose and use of the mat. The mats will be wrapped, packed and stored.

The size of mat both in depth and surface area can vary. Surface area from 0.1 square [metres] meters (1.076 square feet) or less to 2 square [metres] meters (21.28 square feet) or more. Depth of mat from 2 [centimetres] centimeters (0.787 inches) or less 40 [centimetres] centimeters (15.748031 inches) or more, as required for their purpose.

It is envisaged that in mats constructed on which grass seed is sown, for the growth of turf, the walls comprising the sides of the container could be 2 [centimetres] centimeters (0.787 inches) higher than the tubes comprising the matrix to form a lip and container for the seedbed in which the grass will grow. It is envisaged that the dry filler material dispensed via the storage hopper could be replaced with a semi-dry soil/[papier] paper mache mixture. The method of construction would be the same as previously described. However, the mats once constructed would pass by conveyor belt through a continuous oven to remove moisture prior to wrapping

through a dye to give a continuous sheet of 30 cm. (11.81 inches) width by 4 cm. (1.58 inches) depth. The dimension can be altered to give mats of different sizes as required.

The extruded continuous mat is rolled to give uniform thickness and passed through a continuous dry oven. The matting can be cut into the required length either prior to or after drying. A plastic or cardboard edging can be wrapped around the side for added protection and strength in handling, package and storage. The dry mats are wrapped, packed and stored.

It is envisaged that a method of production for the [papier] paper mache soil mats would be by vacuum forming over a form or template. This can be done to form discrete mats of various sizes but typically of 30 cm. (11.81 inches) width, [width 30cm] 30 cm. (11.81 inches) length 30cm. and 4cm. (1.57 inches) depth. [depth 4cm.] The mats would be rolled to give uniform thickness and passed through by conveyor in a continuous drying oven. Vacuum forming could also produce continuous roll of matting which could be cut into discrete mats prior to or after drying the mixture content. The moisture content, after drying, of the mats can vary from virtually nil, for storage, to a moisture content allowing immediate use. Dry mats would be re-hydrated with a known quantity of water prior to their use.

A mat of low adhesive properties of their component parts can be produced by mixing organic compost or peat with a high plant [fibre] fiber content with known quantity of water, mixing thoroughly and forming into mat as described in product-ion method for the [papier] paper mache mats described on panes 28 and 29.

A mat consisting of only [papier] paper mache can be formed. The compactness of this can be varied by the pressure exerted by rolling or the vacuum force used in its production. High pressure producing a compact mat with few air spaces between the [fibres] fibers. Low pressure less compact softer mat with many more airspaces between the [papier] paper mache [fibres] fibers. The mats would be formed by production for [papier] paper mache mats as described on pages 28 and 29, or by any other suitable means.

It is envisaged that the [papier] paper mache soil mixture can be [utilised] utilized to form a mat without using a matrix of tubes. It does not have the integral strength and durability of a mat formed with the matrix of tubes but could be [utilised] utilized to form a mat with a limited lifespan and of a more disposable nature. This allows the production of mats with different soil [consistancies] consistencies which allow the practice with wide range of golf clubs and golf shots, especially the more lofted clubs which can take large divots and may cause substantial damage to the mat with less experienced golfers. However, this would not cause a problem as the mat could be purchased and used by a individual golfer.

In some cases various plastics can be mixed with the [papier] paper mache such as polystyrene in the form of spheres of various sizes and shapes to form a material which exhibits similar properties to [papier] paper mache/soil mat.

The [papier] paper mache can be replaced by a system of natural [fibres] fibers, wool, hair, plant [fibre] fiber or man made [fibres] fibers of plastic or any other suitable [fibre] fiber, and natural glues or adhesives and manufactured glues and adhesives to form a mixture to replace the [papier] paper mache mixture.

The [papier] paper mache mixture can be used by mixing with the above-described mixtures in varying proportions.

A mat can be produced without using a matrix of tubes using a [papier] paper mache and soil mixture. These mats do not exhibit the strength or durability of the mats containing the matrix of tubing but have the advantage being for the use by an individual golfer and being of a disposable nature.

It is envisaged that one method of production would be to mix the [papier] paper mache and soil as described, remove the excess water by mechanical straining and compression, remix the resultant mixture and place in cardboard or [papier] paper mache boxes of the dimensions of 30 cm. (11.81 inches) square and 4 cm. (1.58 inches) square depth. The mixture is tamped and rolled and then passed through continuous dry ovens to remove moisture then wrapped, packed and stored. It is also envisaged that the mats could be produced by mixing the soil and [papier] paper mache, straining removing excess water, remixing then extruding this dryer mixture

and packing. The use of [papier] paper mache in the construction of the mat gives the advantage of greater cohesion and binding of the soil particles therefore providing added strength and durability of the mat.

It is envisaged that the [papier] paper mache to be used is provided by mechanically mixing in the ratio 20 gram (0.705 ounces) of newsprint with 1 [litre] liter (1.32 gallons) of water. The temperature of the water can vary from 0 degrees [centigrade] Centigrade (32 Fahrenheit) to 100 degrees [centigrade.] Centigrade (212 Fahrenheit). The paper can be used as large sheets of newsprint or shredded newsprint. The newsprint can be new or recycled. The ratio of the dry weight of newsprint to water can vary. Decreasing the weight of newsprint or increasing the volume of water and thorough mixing gives [papier] paper mache or finer [fibre] fiber separation but has less cohesive and adhesive properties. The converse is true.

Typically the material used in the composition of mats is in the [ration] ratio of volume of 5 [litre] liter (1.32 gallons) of [papier] paper mache to 5 [litre] liter (1.32 gallons) of soil component. The [papier] paper mache and soil is thoroughly mixed and the excess water strained out by compression through a fine metal sieve. The soil content mixed with the [papier] paper mache can vary from inorganic sand and clay to organic composts and peat. The percentage proportions of each can vary from 100% to nil, according to the properties required of the mat for the type of club and golf shot to be practiced.